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for the Behavioral and Social Sciences**

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**The Computer Background of Soldiers in
Infantry Courses: FY01**

Harnam Singh and Jean L. Dyer
U.S. Army Research Institute

December 2001

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**U.S. Army Research Institute
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Research Report 1784

The Computer Background of Soldiers in Infantry Courses: FY01

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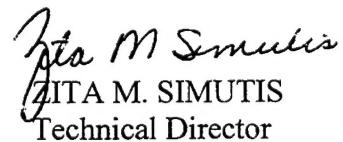
FOREWORD

Advanced digital systems are increasing within the U.S. Army. Computer software is embedded in vehicles such as tanks, command and control vehicles, Infantry fighting vehicles, and wearable computers. The training requirement associated with each system must be specified. The size and nature of that requirement depend, in part, on the computer skills and knowledge the individual soldier brings to the training.

In FY99, the Infantry Forces Research Unit of the U.S. Army Research Institute for the Behavioral and Social Sciences initiated a three-year effort to determine the computer experience and background of soldiers enrolled in four different courses at the Infantry Center and School, Fort Benning, Georgia. The primary purpose of this effort was to determine the computer status of these soldiers, which was unknown at that time and the subject of much speculation. The secondary purpose was to determine if any segments of the Infantry population might benefit from basic computer training prior to working with tactical digital systems. This report presents the results of the third and last year of the Infantry course surveys, conducted in FY01. The courses surveyed were Infantry One Station Unit Training (OSUT), the Basic Noncommissioned Officer Course (BNCOC), the Advanced Noncommissioned Officer Course (ANCOC), and the Infantry Officer Basic Course (IOBC).

A relatively consistent picture existed among the computer dimensions covered in the survey. The greater the computer background and use, the higher the soldiers' perception of skill and the higher the scores on a test of computer knowledge. Computer experience was gained in different ways. However, a large percentage of soldiers from every group both owned and used a computer, and use at home was very typical. Overall, the courses ordered from high to low on computer expertise as follows: IOBC, ANCOC, BNCOC, and OSUT. It was estimated that about half the younger soldiers would benefit from training on basic computer skills and software applications prior to specialized training on a tactical computer system. Although only Infantrymen were surveyed, the results should apply to other Army soldiers with similar educational and military experience.

The information in this report is of value to individuals designing training programs for soldiers who will use the computer software embedded in the Army's tactical systems. The findings were briefed to representatives from the U.S. Army Infantry School in July 2001 and to the Land Warrior MANPRINT Working Group in August 2001.



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THE COMPUTER BACKGROUND OF SOLDIERS IN INFANTRY COURSES: FY01

EXECUTIVE SUMMARY

Research Requirement:

The Army has introduced digital systems throughout the force. Digital system software is embedded in vehicles such as tanks, command and control vehicles, and Infantry fighting vehicles. In addition, the dismounted soldier will eventually have a wearable computer, such as that in the Land Warrior system. The ability of soldiers to fully exploit digital system capabilities and learn system software quickly depends in large part on the user's prior computer experience. In FY99, a three-year research effort was initiated to obtain a picture of the computer backgrounds of soldiers and to determine whether segments of the Infantry population would benefit from basic computer skill training prior to working with tactical digital systems. This report presents the results of the third and last year of the surveys of soldiers in Infantry School courses.

Procedure:

Soldiers were given a survey that assessed their experiences with computers, self-perceptions of their computer skill, and an objective index of skill as measured by the ability to identify commonly used, Windows-based icons. The soldiers surveyed represented the rank and experience structure of an Infantry rifle platoon; that is, soldiers enrolled in Infantry One Station Unit Training (OSUT), the Basic Noncommissioned Officer Course (BNCOC), the Advanced Noncommissioned Officer Course (ANCOC), and the Infantry Officer Basic Course (IOBC). A total of 723 soldiers was surveyed.

Findings:

The results showed a consistent picture among the computer dimensions in the survey. The greater the computer background and use, the higher the soldiers' perception of their skill and the higher their scores on an index of computer knowledge. Moreover, the findings are consistent with the relatively rapid increase in the availability of personal computers in American society. Computer experience was gained in different ways, reflecting the circumstances in which computers were used by the different groups surveyed. For instance, the youngest soldiers (OSUT) had the greatest exposure to computers in high school. On the other hand, the oldest soldiers (ANCOC) had the least exposure to computers in high school. Yet there were commonalities among the groups, with a large percentage of all soldiers owning a computer and using a computer at home. In terms of computer expertise, the groups ordered from high to low on the self-ratings and icon scores as follows: IOBC, ANCOC, BNCOC, and OSUT.

Utilization of Findings:

When the research was initiated there was much speculation about the computer skills of soldiers. A typical assertion was that the young soldiers out of high school are computer literate while senior noncommissioned officers have limited skills. The survey results do not support those assertions. In fact, it was estimated that about half the younger soldiers in BNCOC and OSUT populations had limited computer skills and would benefit from training on basic computer skills and different software application programs. On the other hand, the IOBC soldier group was the most homogeneous and also the highest on most measures of skill and use, indicating little to no need for basic computer skill training. In many regards the ANCOC soldiers were very similar the IOBC group, which was not the case in the first year of the surveys. The results should apply to other Army soldiers and leaders with similar educational and military experience. Training on the Army's tactical computer-based systems will be more efficient and effective if the soldiers with limited computer skills are identified and provided basic computer and software application training before their specialized training.

THE COMPUTER BACKGROUND OF SOLDIERS IN INFANTRY COURSES: FY01

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The Computer Background of Soldiers in Infantry Courses: FY01

Introduction

Advanced digital systems are increasing within the U.S. Army. Digital system software is embedded in vehicles such as tanks, command and control vehicles, and Infantry fighting vehicles (General Accounting Office [GAO], 2000). In addition, the dismounted soldier will eventually have a wearable computer, such as that in the Land Warrior (LW) system (Goodman, 1999). Each of these software systems is unique and soldiers must be trained to use them. Moreover, the system software typically requires some basic understanding of and skill with computers.

In FY99, the Infantry Forces Research Unit of the Army Research Institute for the Behavioral and Social Sciences initiated a three-year effort to determine the computer experience and background of soldiers enrolled in courses at the Infantry Center and School at Fort Benning, Georgia. The primary purpose of this effort was to determine the computer knowledge and skills of these soldiers, which was unknown at that point and the subject of much speculation. The secondary purpose was to obtain an estimate of whether any segments of the Infantry population might benefit from basic computer skill training prior to working with tactical digital systems. This report presents the results of the third and last year of the Infantry course surveys, which were conducted in FY01. Survey results from the prior two years, FY99 and FY00, can be found in Dyer and Martin (1999) and in Fober, Bredthauer, and Dyer (2000).

Background

A critical issue for the military is how task expertise and computer software expertise jointly affect the ability of soldiers to work effectively with computer systems. We found no military studies that specifically addressed this issue. But presumably competency in both areas, tasks and software, is required. Research by McKay and Elam (1992) in the domain of health care provides some insights into the relationship between task expertise and computer software expertise. They found that health care planning experts with no spreadsheet skills were hindered in solving problems when required to use a spreadsheet as a decision-aid, compared to experts who were skilled in the use of spreadsheets. The experts with no spreadsheet skills performed at the level of individuals who were not experts in healthcare planning. McKay and Elam concluded that individuals need to have a given level of expertise in using software before they can effectively apply their task domain knowledge to the problem at hand.

Training people to use computers is hampered when the target audience is composed of individuals possessing varying levels of computer expertise. Experienced individuals will require advanced training to increase their skill levels, whereas novices will experience great difficulty learning advanced material without first being exposed to introductory-level training (Van Vliet, Kletke, & Chakraborty, 1994). A “one size fits all” approach to training is probably inefficient. Trumbly, Arnet, and Martin (1993) found that the task performance increased significantly when the software interface characteristics were matched to user computer knowledge (e.g., expert interface to expert user). Research also shows that self-taught users are

beset by a “motivational paradox” (Carroll & Rosson, 1987) where the goal to complete work conflicts with the goal of learning about the system. As a result, users learn only a subset of the commands available to them and make poor use of manuals, which frequently are not well suited for self-directed learners. In addition, self-taught users may lack the metaknowledge that tells them what they do not know (Briggs, 1990).

Given these findings, especially when resources are limited and training efficiency is important, it makes sense to assess the computer knowledge and skills of users before starting training programs on new software applications. The research described in this report was an effort to gain insights into the computer status and training needs of the soldiers typical of an Infantry rifle platoon. When the research was initiated, the general perception of soldier computer skills was that young soldiers just out of high school have computer skills, but that senior NCOs have limited computer skills. The surveys provided a means of examining the validity of these assertions. The Land Warrior system, a dismounted soldier system where the computer is a critical component, served as the impetus for the original research in 1999 (Dyer & Martin). However, the course survey results from all three years apply to both the dismounted and mechanized Infantry soldier populations.

The Infantry rifle platoon is composed of soldiers with considerable differences in Army experience, educational backgrounds, and ages. We surveyed soldiers in four professional development courses at Fort Benning, Georgia, who mirrored all positions within a typical Infantry platoon except for the ranks of specialist and corporal. The institutional courses were Infantry One Station Unit Training (OSUT), the Basic Noncommissioned Officer Course (BNCOC), the Advanced Noncommissioned Officer Course (ANCOC), and the Infantry Officer Basic Course (IOBC). The same survey instrument was used each year in order to determine the stability of the results within the same Infantry populations.

The prior surveys (Dyer & Martin, 1999; Fober, et al., 2000) showed considerable diversity of computer skill within the Infantry population, ranging from soldiers with no computer experience to soldiers who could program. This diversity was greatest within the OSUT, BNCOC, and ANCOC subgroups. These results also showed that a considerable percentage of soldiers (50 to 60% from the OSUT and BNCOC soldiers) would benefit from training on basic computer skills prior to learning a tactical software application.

Method

Participants

Soldiers ($n = 723$) were surveyed from four professional development courses conducted at Fort Benning, GA. These courses were Infantry OSUT ($n = 251$), IOBC ($n = 142$), BNCOC ($n = 139$), and ANCOC ($n = 191$). The distribution of military ranks within each course is shown in Table 1.

Table 1

Number of Soldiers by Rank in Each Professional Development Course

Rank	Soldier Group			
	OSUT	BNCOC	ANCOC	IOBC ^a
Private	All 251	NA	NA	NA
Specialist/Corporal	NA	NA	NA	NA
Sergeant	NA	42	NA	NA
Staff Sergeant	NA	97	103	NA
Sergeant First Class	NA	NA	87	NA
Lieutenant	NA	NA	NA	141
Captain	NA	NA	NA	1

Note. NA means "not applicable."

^a Source of commission was available on 136 of the 142 IOBC students. Of the 136, 31% were prior noncommissioned officers being commissioned through Officer Candidate School (OCS), 48% were commissioned through Reserve Officer Training Corps (ROTC), 20% from the U.S. Army Military Academy, and 1% from the U.S. Air Force Academy.

Figure 1 illustrates the overall trend in ages of the soldiers attending the professional development courses as well as the age spread within each course. As anticipated, the youngest groups were Infantry OSUT ($M = 20.43$, $SD = 2.97$) and IOBC ($M = 25.22$, $SD = 3.43$). The oldest group was the ANCOC class ($M = 33.38$, $SD = 3.57$), with BNCOC about 5 years younger ($M = 27.99$, $SD = 3.44$). Furthermore, as illustrated in Figure 1 and documented in Table A-1 (in Appendix A), there was considerable variability in age within each group, especially within ANCOC (25 years) and BNCOC (18 years). The spread in ages was least within OSUT and IOBC (15 years). Within ANCOC, this large range in age was due to one soldier who was 52 years old, the next oldest was 44. Within each course, the ages were skewed positively, as reflected in Figure 1. However, Figure 1 also shows that within each group, the age range of the middle 50% was only 5 years.

Because OSUT soldiers were not asked how long they had served in the Army, no data are presented on time in the Army for this group. But as would be expected, the months served in the Army was lowest for IOBC ($Mdn = 11$ months), next highest for BNCOC ($Mdn = 83$ months or 7.1 years), and highest for ANCOC ($Mdn = 160$ months or 13.3 years). Table A-2 and Figure A-1 present additional results on time served.

Survey Instrument

The survey instrument is in Appendix B. The same survey was used in the FY99 and FY00 research (Dyer & Martin, 1999; Fober, et al., 2000). The demographic information was tailored to fit the specific group surveyed. In addition to demographic information, the survey focused on seven areas:

- Where soldiers used computers in their formal education.
- Where they currently use computers.

- Whether they owned a computer.
- How often they use specific computer features: a mouse, computer games, icon-based software, pull-down menus, graphics/drawing features, e-mail, and the Internet.
- Self-ratings of typing skill.
- Self-ratings of computer skill and what computer software/languages they use.
- An icon test with icons common in current Windows-based software programs. Soldiers had to name the function or purpose of 18 icons. The icons on the test were: spell check, cursor, zoom, open file, save, print, cut, copy, paste, undo, new file, arrow, recycle, help, center, fill, close, and group.

A coding scheme was developed for scoring the icon responses. It is presented in Appendix C. Some latitude was given to scoring answers, as the icons have slightly different meanings within various software programs (e.g., word processing and the Internet).

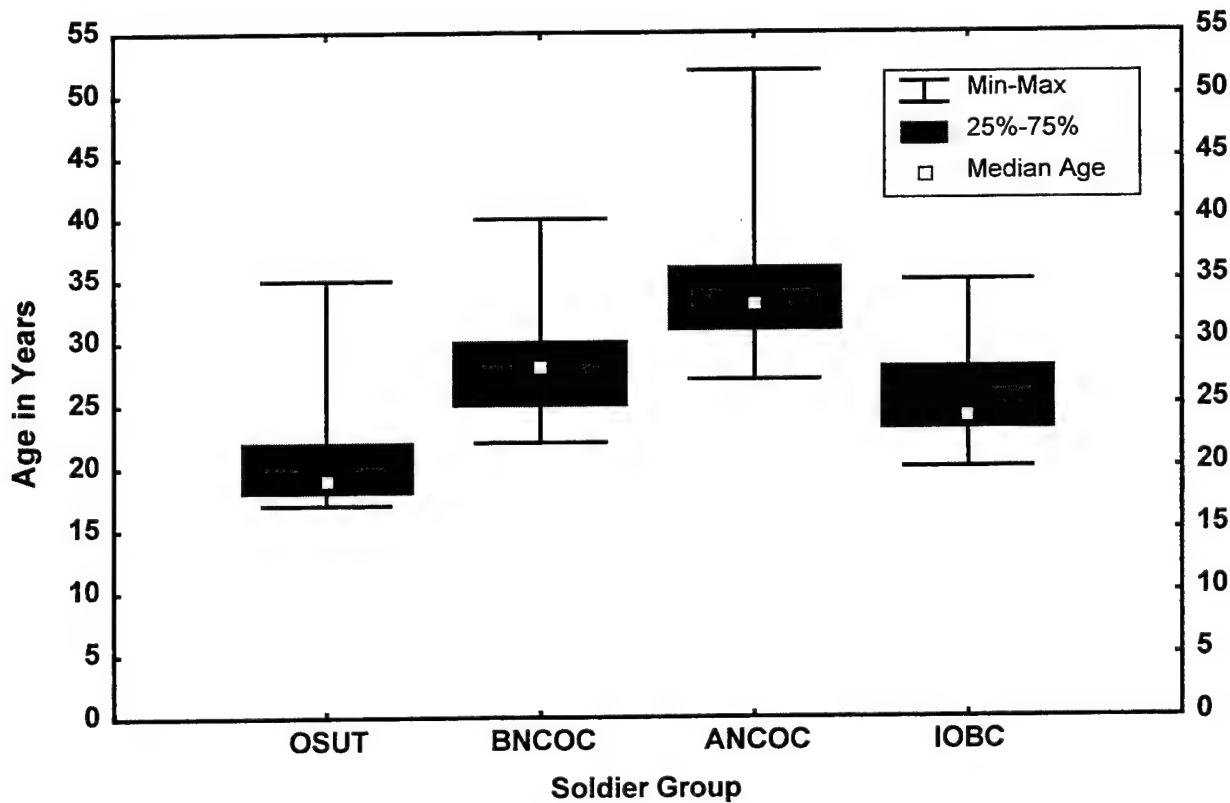


Figure 1. Box plot of soldier age in each group surveyed.

Results

Computer Use

The survey was designed to obtain information about the soldiers' background and experience using computers. Of primary concern was the degree to which soldiers used computers in their formal education. As illustrated in Figure 2, as soldiers progressed from grade school through high school, there was a steady increase in the percentage who used computers, regardless of the group surveyed. Because educational requirements varied across groups, the percentage using a computer in college did not apply equally to all the groups surveyed. However, almost all IOBC students (88%) used a computer in college. The group with the highest percentage of soldiers using computers from grade school through high school was OSUT. The group with the lowest percentage was ANCOC. Given that the availability of computers in school settings is a relatively recent phenomenon partially due to decreases in costs and a push by local and Federal governments to provide computers in every school, it is not surprising that the percentage of soldiers using computers in high school paralleled the average age of each group. Going from the youngest to the oldest group, the percentages of soldiers using computers in high school were as follows: OSUT (79%), IOBC (68%), BNCOC (55%), and ANCOC (27%). The strong negative linear relationship ($r = -.98$) between the groups' mean ages and their percentage use of computers in high school is clearly illustrated in Figure 3.

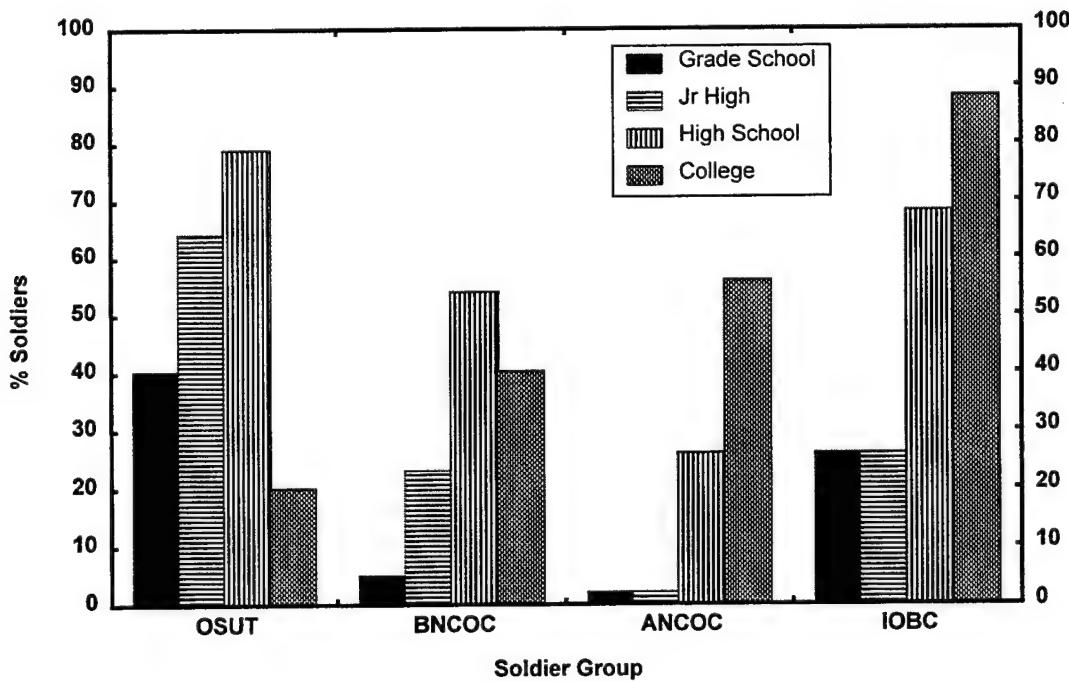


Figure 2. Percentage of soldiers using a computer in grade school, junior high, high school, and college.

The percentage of soldiers within each group who used a computer in college was a function of how many actually had attended college. But only OSUT soldiers were specifically asked about college attendance. Using the OSUT data, we found that 76% of the 59 OSUT soldiers who had been to college used a computer there. This percentage is lower than, but similar to, the percentage of IOBC students who said they used a computer in college (88%). In general, the survey findings indicate that at least 75% of the OSUT and IOBC soldiers who have attended college have used a computer in that setting.

Another way of examining computer use in school was to total the number of educational settings where soldiers used a computer. Because few soldiers indicated technical school use, these data were collapsed with the college category. The results are illustrated in Figure 4 and tabulated in Tables A-3 and A-4. A significant point is that more than one quarter (29%) of the ANCOC soldiers and one fifth (20%) of the BNCOC soldiers had never used a computer in a formal school setting as compared to very few OSUT (8%) and IOBC (2%) soldiers. Half the ANCOC and BNCOC soldiers had used a computer in only one school setting. In contrast, 65% of OSUT and IOBC soldiers had used computers in at least two educational settings. The difference in the number of settings where the groups used computers throughout their education was statistically significant, $\chi^2(15) = 174.93, p < .000$. An analysis of variance (ANOVA) on the mean number of settings was also significant, $F(3, 718) = 63.79, p < .000$. IOBC and OSUT had higher means than BNCOC and ANCOC (Bonferroni test, $p < .00$), consistent with the relative ages of the soldier groups.

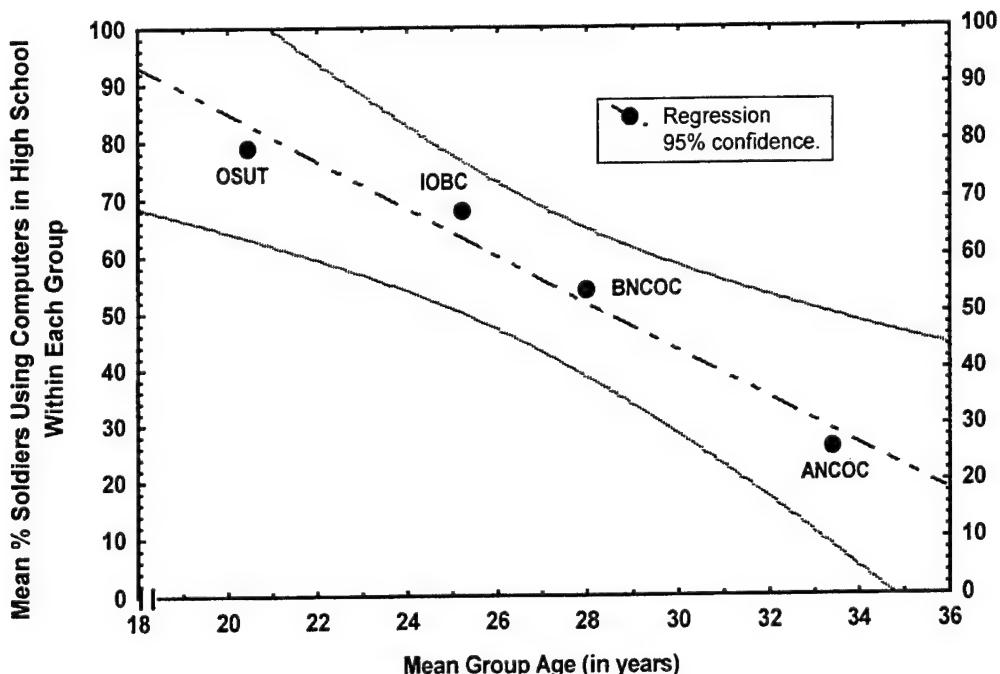


Figure 3. Relationship between mean age of the groups surveyed and mean percentage using computers in high school.

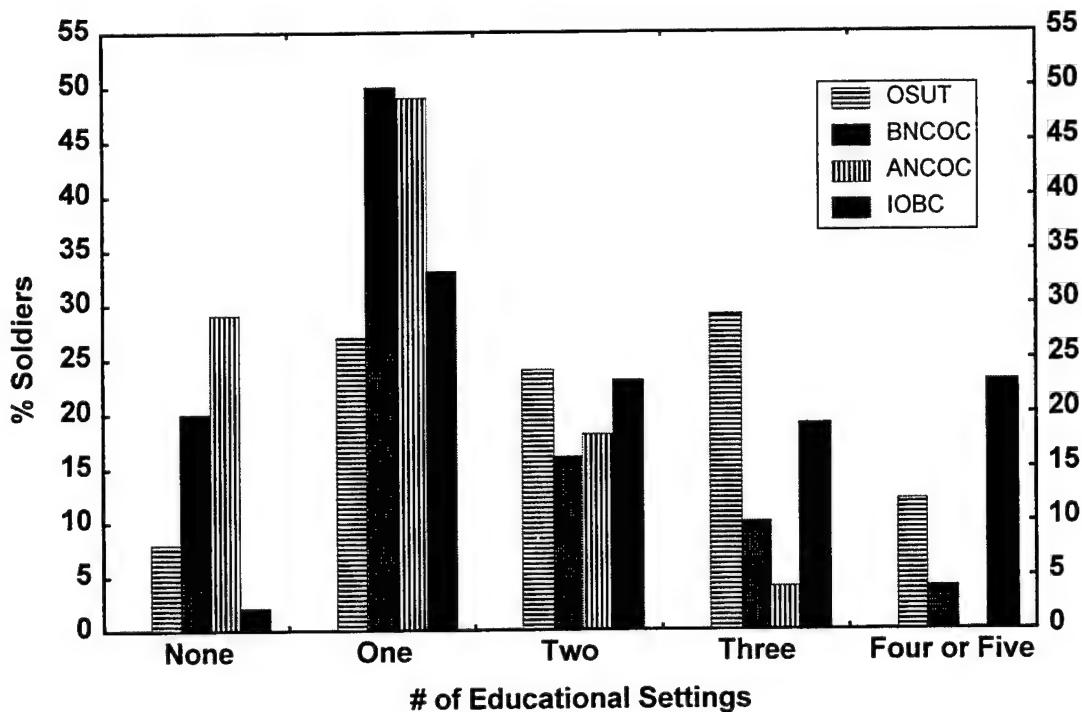


Figure 4. Number of educational settings (summed over grade school, junior high, high school, and college) where soldiers used computers.

One key question concerning computer use was whether soldiers owned a computer. Obviously, this could depend on whether they had a personal need for a computer, whether they could afford one, and other factors. Collapsed across the four soldier groups, 75% of the soldiers owned a computer. But there was a significant difference among the groups, $F(3, 718) = 22.28$, $p < .000$, with fewer OSUT soldiers owning a computer compared to the other three groups (Bonferroni test, $p < .01$). The computer ownership percentages were 89% for ANCOC, 81% for BNCOC, 79% for IOBC, and 59% for OSUT, as shown in Figure 5.

We also asked where soldiers currently used a computer: at home (or in barracks or the bachelors officer quarters), in a training facility (library, learning center), and/or in their unit or work site. For the OSUT soldiers, this question was modified to ask where they used computers before coming to OSUT. During OSUT, soldiers do not have access to their computers; hence, the need to change the question. The locations available for soldiers to use computers depended on where they were assigned, and their status within the Army (e.g., OSUT and most IOBC students have not been assigned to a unit). Overall, a high percentage (at least 86%) in each group said they currently used a computer (see Figure 5 and Table A-5). But there was a significant group difference, $\chi^2(3) = 30.02$, $p < .0000$, with the percentage of OSUT soldiers significantly lower than the other groups. Figure 5 also reveals that, for each group, the percentage of soldiers using a computer was higher than the percentage owning a computer.

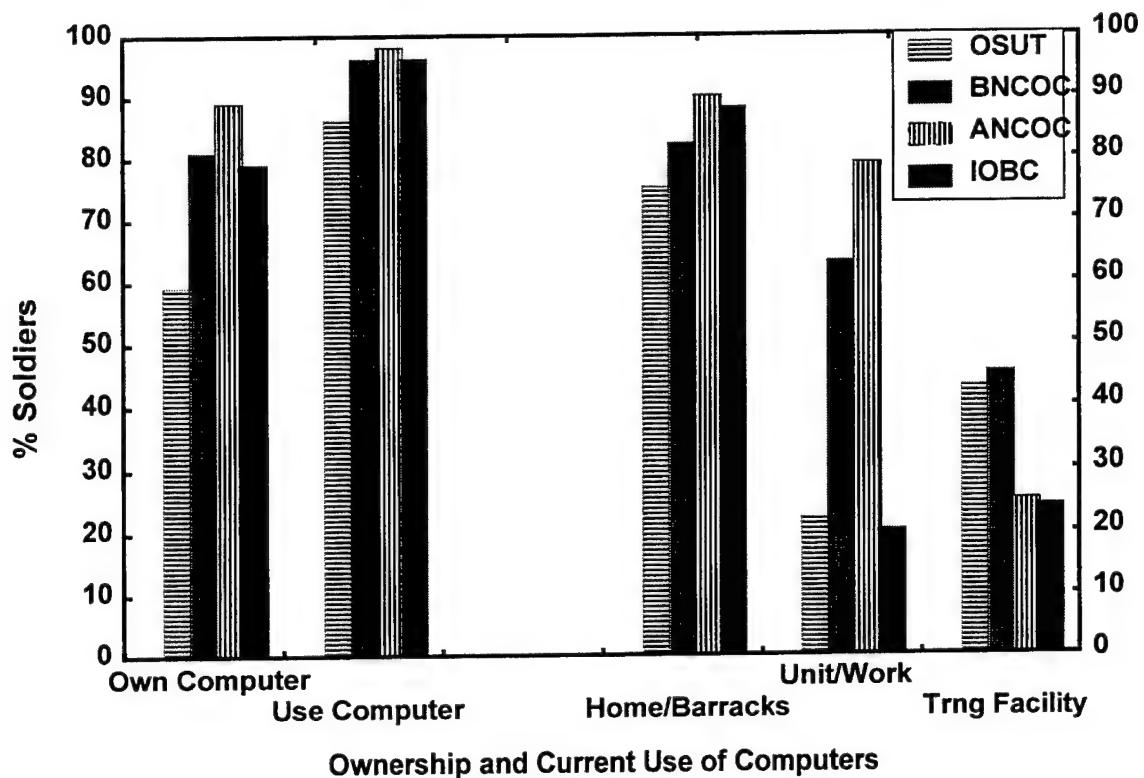


Figure 5. Current computer ownership, use of computers, and usage locations.

The most common location for using a computer was at home (in the barracks or the bachelors officer quarters). This percentage ranged from 75% to 90% across the four groups. Both ANCOC and BNCOC students indicated they frequently used the computer at work/in the unit. Although this type of usage was expected, the percentage of ANCOC and BNCOC students who indicated using a computer in their unit was high (79% and 63% respectively).

Subjective Indices of Computer Skill and Expertise

The survey provided several subjective indices of computer skill: the frequency with which different software features are used, self-ratings of expertise with computer software, use of specific software packages, and self-ratings of typing skill. Although, typing skill is not a direct index of computer skill, soldiers who use a computer intensively are familiar with a keyboard, whether it be touch typing or fast hunt and peck skills developed on their own. And those who know a typewriter keyboard are less likely to be intimidated by this particular hardware interface.

Typing skill. The pattern of responses for the IOBC students differed from the other groups, $\chi^2(9) = 47.15, p < .000$ (see Figure 6 and Table A-6). For IOBC students, almost two-thirds (65%) stated they could type vs. hunt and peck. However, for each of the other groups, less than half (42% to 45%) stated they could type. In fact, the IOBC students were very likely to say that they could type quickly (41% vs. 15% to 20% for the other groups). Figure 6 shows

that no more than 16% of any group indicated that their typing ability was limited to only hunt and peck slowly at a keyboard.

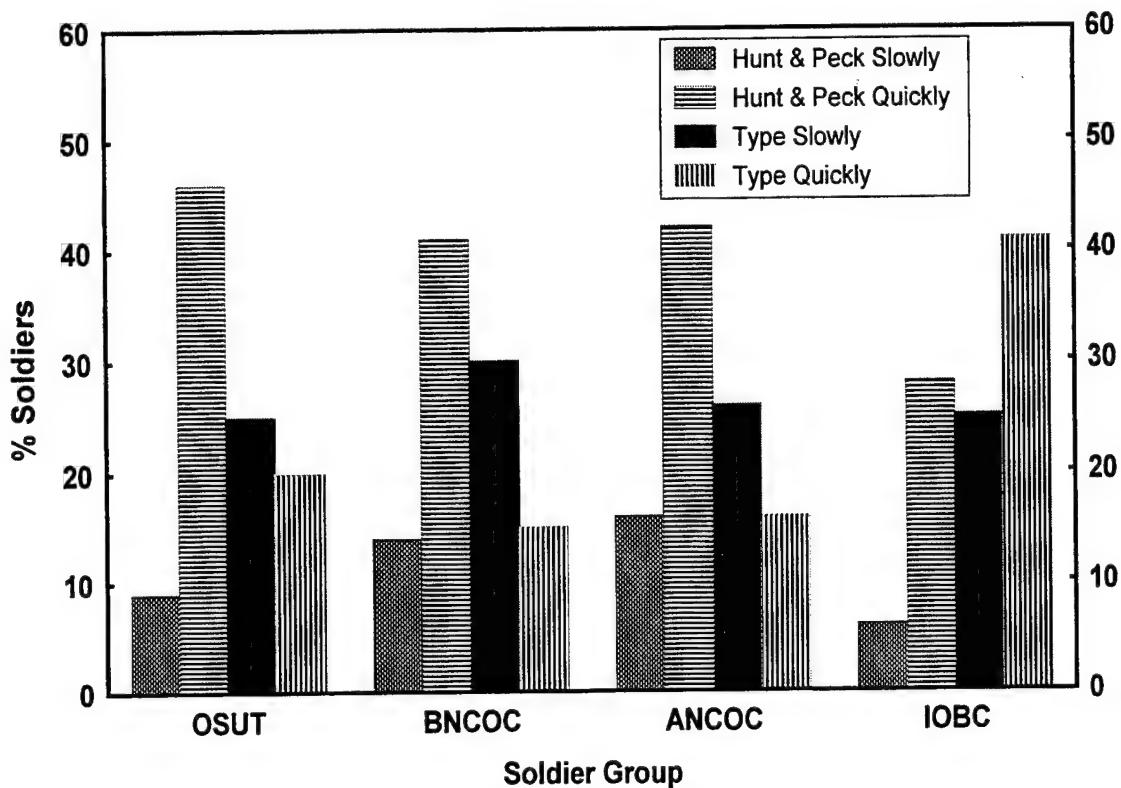


Figure 6. Self-ratings of typing skill.

Computer features. Soldiers were asked how frequently they used seven computer features: mouse, games, software with icons, software with menus, graphics, e-mail, and the Internet. The frequency scale had five-points ranging from daily, weekly, monthly, less than monthly, to never. A 4×7 ANOVA (soldier group by computer features with repeated measures on the last factor) was used to compare the soldier populations on the scale scores. There was a main effect for soldier group, $F(3, 718) = 6.69, p < .000$, a main effect for features, $F(6, 4308) = 309.51, p < .000$, and an interaction, $F(18, 4308) = 15.10, p < .000$. The trends shown in the analysis of means are reflected in the breakout of responses by each usage category presented in Table A-7. A complete tabulation of the responses by percentage of soldiers who responded to each category is in Table A-7. Means and standard deviations for each soldier group are in Table A-8.

Post hoc comparisons (Bonferroni test, $p < .01$) on the group main effect showed that the ANCOC group was higher than the OSUT group. Post hoc comparisons on the feature effect showed significant differences among all features. From highest to lowest frequency of use, the features ordered as follows: mouse, Internet, e-mail, menus, icons, games, and graphics. Finally, these overall effects were attenuated by the interaction. As reflected in the interaction shown in Figure 7, the soldier groups generally ordered in accordance with the group main effect

on mouse, Internet, e-mail, menus, and icon features. However, this order shifted for games and graphics. The OSUT students were highest on games and the IOBC students were lowest. On graphics, all groups indicated relatively low frequency of use.

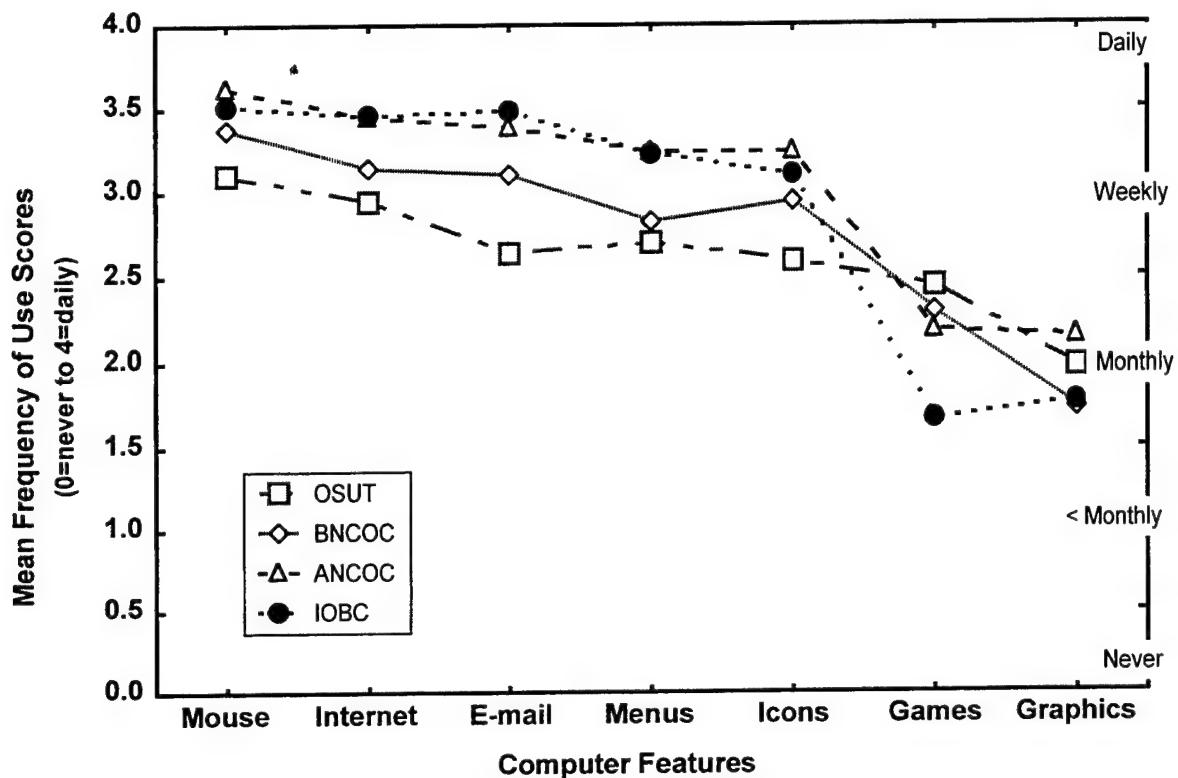


Figure 7. Interaction between soldier group and use of computer features.

Self-ratings of skill. The six-point, self-rating scale asked soldiers to evaluate whether they were computer novices, good with one software application package, good with several software packages, could program in one language, could program in several languages, or were so good that Bill Gates would hire them (i.e., an expert). Approximately 36% of OSUT, BNCOC, and ANCOC soldiers rated themselves as computer novices (Figure 8 and Tables A-10 and A-11). In contrast, only 16% of the IOBC soldiers considered themselves computer novices. The percentage of soldiers who rated themselves as more experienced (i.e., good with at least several software packages) was as follows: IOBC – 59%, ANCOC – 51%, BNCOC – 42%, OSUT – 43%. Figure 8 illustrates that the OSUT, BNCOC, and ANCOC populations, had a large percentage of novices and a large percentage of more experienced users. IOBC did not show this pattern, as they had few novices. The mean ratings for the soldier groups were statistically different, $F(3, 717) = 8.77, p < .000$. Post hoc comparisons (Bonferroni test, $p < .01$) showed that IOBC had higher self-ratings than each of the other three groups.

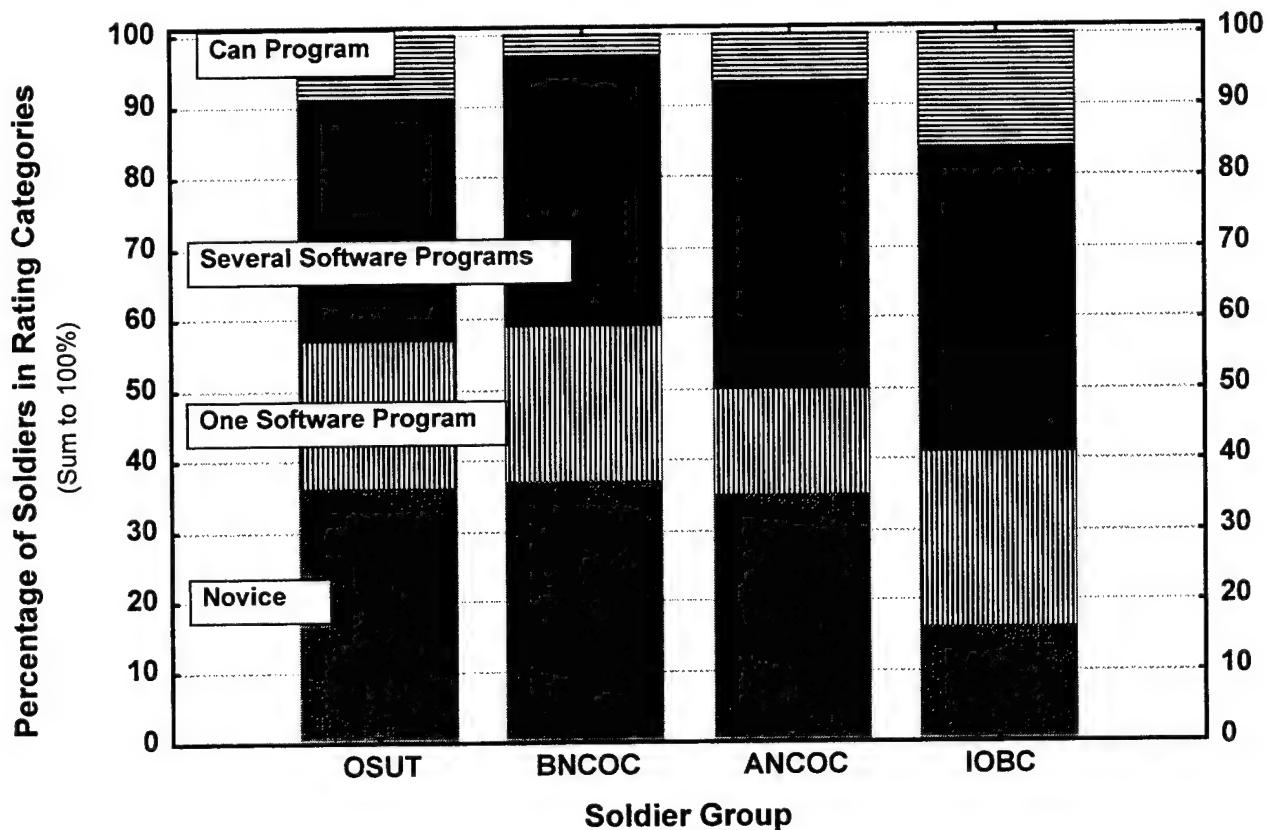


Figure 8. Self-ratings of computer skill.

Software programs and programming languages. Soldiers were asked to name the software packages they used, and the computer languages they knew. The software package question was directed at the soldiers above the level of novice on the self-rating scale (see survey in Appendix B). Novices should not have listed any software packages. However, we examined the types of software used by all soldiers as well as by those who rated themselves above the novice category (the “non-novices”). Only 18 of the 231 soldiers who considered themselves novices answered the software question. Tables A-12 and A-13 provide percentages for all soldiers (novices and non-novices).

Of primary interest was the software packages typically used by soldiers indicating they were not novices. Of the 490 non-novice soldiers, 371 or 76% responded to the question (Table A-14). The software packages were divided into six categories: office type (e.g., Microsoft Office, Microsoft Works, Lotus Smart Suite), word processing, spreadsheet, graphics, operating systems, and other software. We determined the percentage of soldiers who listed at least one program from each of these categories. Across all groups, the most common software category was word processing, marked by 57% of the non-novice soldiers who responded to the software package question. The other five categories were each cited by 25% to 40% of these soldiers (see Table A-14).

We also determined, within each software category, what specific commercial programs (such as Word and Word Perfect word processor programs) were commonly used. For these tabulations, we examined only the soldiers who listed a software program (or programs) within a specific category. Since a soldier could indicate that he knew more than one word processing program or more than one spreadsheet program, the sum of the percentages within a category could be greater than 100%. These results clearly showed that within each category, Microsoft products were the most common. Within the spreadsheet category, 96% of the soldiers cited Excel. The corresponding percentages in the other categories were: Word processing – Word (90%); Office Type - Microsoft Office (82%) and Microsoft Works (16%); Graphics – Power Point (71%); and Operating systems – Windows (93%). A complete breakout of these responses is in Table A-16. Furthermore, these patterns were typical of each group of soldiers. The one distinct pattern that occurred was that the ANCOC and BNCOC soldiers specified Delrina Form Flow.

The second software question addressed the programming languages soldiers used. Only soldiers who indicated they knew a programming language on the self-rating scale should have answered this question. Nonetheless, 15 of 426 non-novice soldiers responded to the question (see Table A-15). Of the 64 soldiers who indicated they had programming skill, 37 or 58% cited specific software programs. Of these soldiers, the most common programming languages were Basic, C++, and Pascal (see Table A-17). The IOBC soldiers had the most experience with programming languages; the BNCOC soldiers, the least (see Table A-15).

Icon Test Scores

Groups were compared on the total score on the icon test. The test presented a scanned image of 18 commonly used, Windows-based, icons. Soldiers had to write-in the name of the icon. Soldiers who typically rely on the physical layout of software toolbars to recognize icons out-of-context may have found this test format somewhat difficult. Moreover, the test was not intended to be a comprehensive assessment of software skill and knowledge, but simply an index of soldiers' general knowledge of many commercial software applications.

A scoring code was developed for each icon (see Appendix C). Inter-rater reliability was determined to be 98% during the FY99 and 95% during the FY00 study, and revisions were made to the scoring code (see Dyer & Martin, 1999; Fober, et al., 2000). For the present study, 30 surveys were used to determine inter-rater reliability. Of the 540 total responses, there were 75 instances where the item was left blank. These items were not used in the analysis because there could be no disagreement for no responses. Out of the remaining 465, there were 19 instances where the raters disagreed (inter-rater reliability = 96%).

The icon scores paralleled the group order expertise reflected in other survey measures: IOBC, ANCOC, BNCOC, and then OSUT. IOBC scores ($M = 11.14$, $SD = 3.19$) were highest, OSUT scores ($M = 8.27$, $SD = 3.36$) the lowest, with ANCOC ($M = 10.75$, $SD = 3.38$) and BNCOC ($M = 8.67$, $SD = 3.32$) scores between these groups. Significant differences occurred among the groups, $F(3, 710) = 34.42$, $p < .000$. Post hoc comparisons (Bonferroni test $p < .01$)

of the means showed that ANCOC and IOBC had significantly higher icon scores than OSUT and BNCOC, which can be clearly seen in Figure 9. Descriptive statistics are in Table A-18.

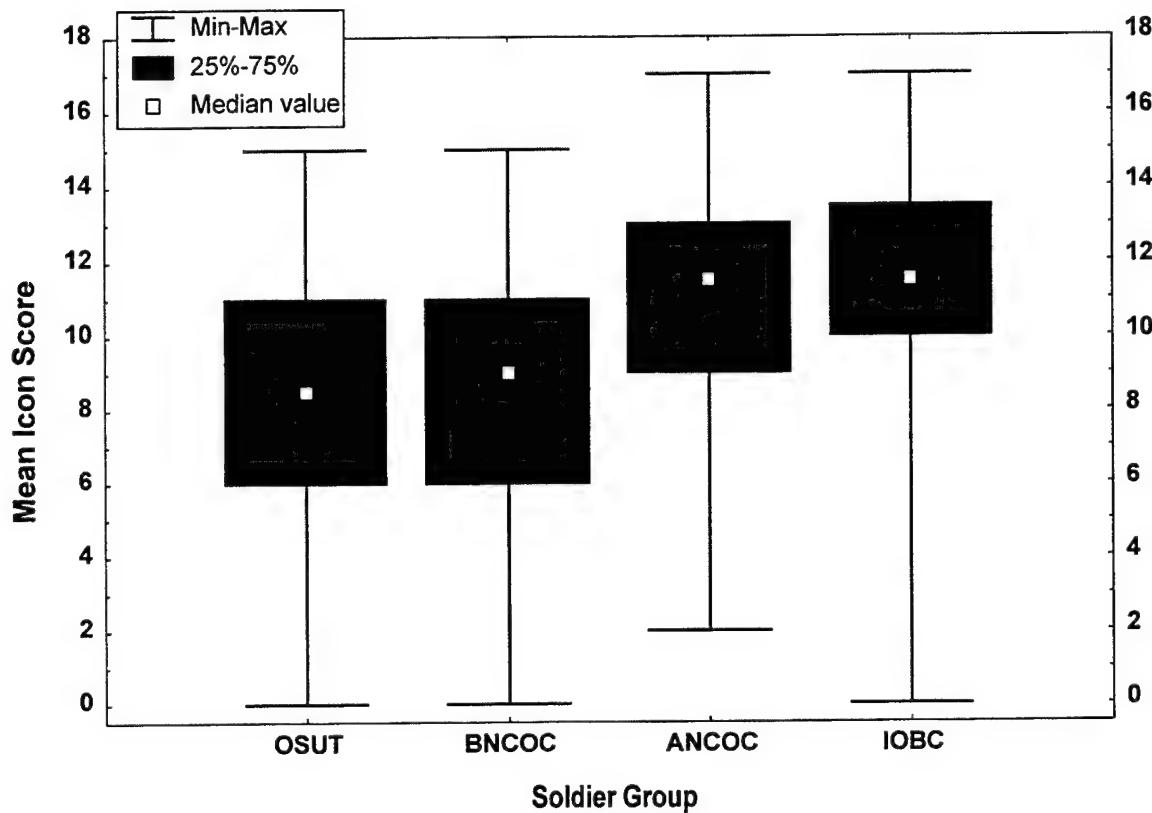


Figure 9. Icon scores by soldier group.

The individual icons differed in difficulty for all soldiers, ranging from a high of 90% correct for the recycle and cut icons to a low of 1% correct for the arrow icon. The solid line in Figure 10 depicts these percentages. The percentages for each soldier group are in Table A-19.

Several other findings are illustrated in Figure 10. The easiest icons (> 75% correct; recycle, cut, spell check, print, and open file) are labeled. The hardest items (< 25% correct, arrow, group, new file, fill, and paste) are also labeled. The remaining eight icons (between 75% and 25% correct) were considered of intermediate difficulty. These icons were help, cursor, zoom, save, close, center, undo, and copy.

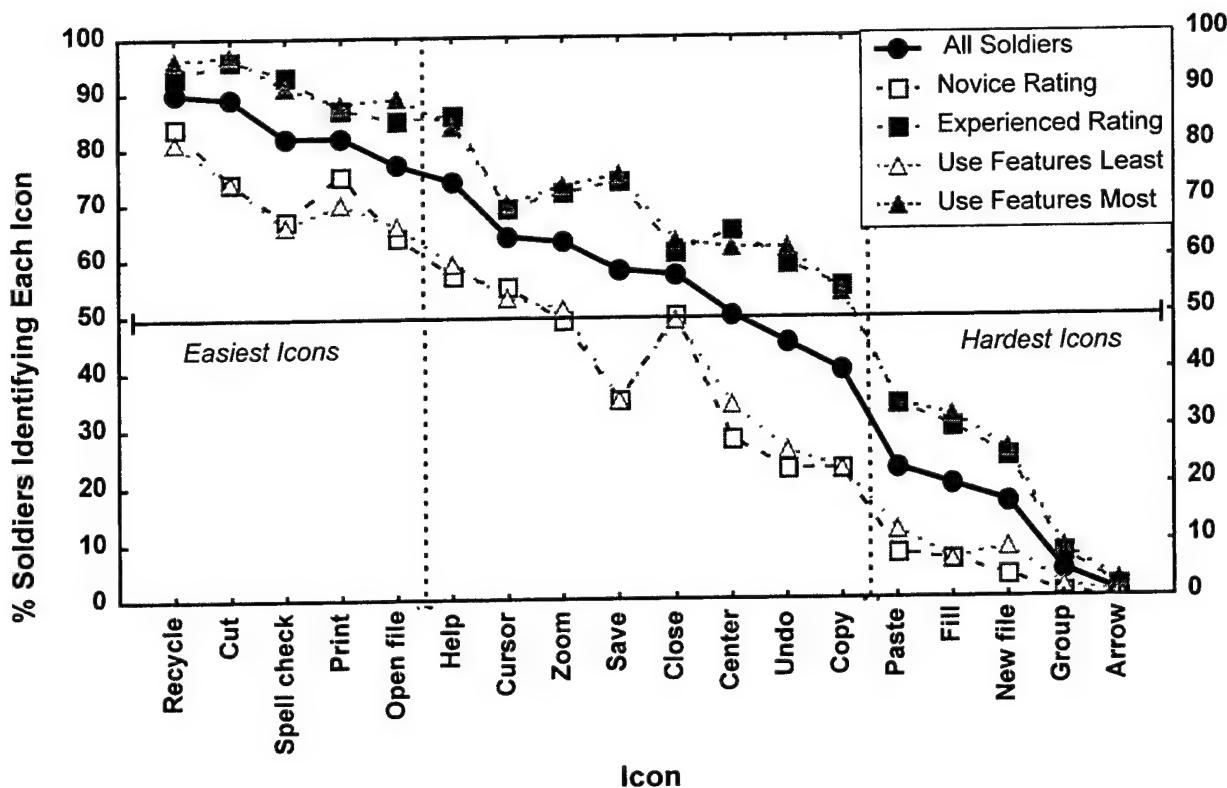


Figure 10. Icon difficulties for all soldiers, by high and low self-ratings, and by high and low use of computer features.

An additional question of interest was whether any survey measures that assessed the soldiers' computer backgrounds distinguished the soldiers who identified the icons from those who missed them. For example, if self-ratings of computer skill and ability to identify the individual icons were related, one would expect more of the experienced soldiers to identify the icons and fewer of the novices to do so. However, for the very difficult or very easy icons, there would likely be less discrimination and this pattern might not hold, as either "all" soldiers would miss the difficult icons or "all" soldiers would identify the easy icons. Figure 10 contrasts novices ($n = 231$) to soldiers experienced with at least several software programs as well as those who said they could program ($n = 344$). The soldiers who stated they were experienced with only one program are omitted from this figure.

The results depicted in Figure 10 show a relationship between self-ratings and icon difficulty, with the more experienced soldiers consistently scoring higher than novices except for the two most difficult icons (group and arrow). In addition, the graph indicates that over half of the experienced soldiers identified 13 of the 18 icons correctly. On the other hand, over half the novices identified only 7 of the 18 icons correctly (see also Table A-20).

A similar analysis was conducted on the relationship between the frequency with which soldiers used the seven computer features covered in the survey and the individual icon scores. The feature usage frequencies were summed to generate a single index of use and the distribution divided into thirds. The actual number of soldiers included in the top third and bottom third

varied slightly because of ties in the frequency index scores. The top third ($n = 265$, 36% of 723) of soldiers in terms of use was compared to the bottom third ($n = 246$, 34% of 723). The top third had usage scores of 24 and above, reflecting a weekly to daily use of all features. The bottom third had scores of 18 and below, reflecting use of all features on a much less frequent basis, less than weekly or monthly.

As shown in Figure 10, the pattern of results for these two groups was identical to that obtained with the self-ratings (see also Table A-20). Over half of the frequent users identified 13 of the 18 icons correctly. On the other hand, over half those who used the computer features less frequently identified only 8 of the 18 icons.

Because the icon percentages for the experienced and high frequency subgroups were almost identical, and the icon percentages for the novice and low frequency subgroups were almost identical, we wanted to know if the soldiers within the respective subgroups were the same. The subgroup memberships were not identical, but there was some overlap. For example, 62% of the novices were also in the low frequency use category, and 58% of the soldiers with the higher self-ratings were in the high frequency use category. In summary, soldiers' perceptions of their computer skill and the frequency with which they used common or typical computer features related to the individual icon scores, except when an icon was very difficult to correctly identify (Figure 10, Group and Arrow icons).

Relationships Among Indices of Computer Skill

Given the relationship between self-ratings and use of features with the individual icons, it was expected that the overall icon scores would relate to the background factors on the survey, both within each soldier group and for all soldiers. These correlations were all significant (see Table 2), except the correlation between computer ownership and icon test scores for the IOBC soldiers.

Table 2
Correlations With Icon Test Scores

Variable	Soldier Group				
	OSUT ($n = 250$)	BNCOC ($n = 139$)	ANCOC ($n = 190$)	IOBC ($n = 142$)	All Soldiers ($n = 722$)
Use Computer Features (Sum)	.59**	.54**	.49**	.42**	.54**
Self-Rating	.45**	.50**	.45**	.37**	.46**
Own a Computer	.27**	.32**	.22**	.10	.29**
Currently Use a Computer	.20**	.20*	.25**	.27**	.24**
# Formal Education Settings Where Used a Computer	.36**	.28**	.32**	.33**	.23**

Note. * $p < .05$, ** $p < .01$.

In general, the relationships for the entire sample were typical of each soldier group. The frequency with which soldiers used computer features and their self-ratings of skill correlated

most highly with the icon scores. Computer ownership, whether soldiers currently used a computer, and the use of computers in formal schooling had lower relationships with the icon scores. The relatively low correlations for soldiers attending IOBC may reflect the homogeneous nature of IOBC. That is, most students owned computers or had easy access to computers and used them on a frequent basis.

The correlations between self-ratings and icon scores ($r = .37$ to $.50$) were similar to those obtained by Van Vliet et al. (1994). Individuals rated themselves on their general skill with computers as well as skill with word processing, spreadsheet, and database software. The objective measures of computer skills were multiple-choice tests in each of the four domains. The correlations between self-appraisals and the test scores ranged from $.40$ to $.56$.

For all soldiers, we also examined the relationship between the frequency with which each computer feature was used and computer ownership, current use of computers, self-ratings, and number of formal educational settings where a computer was used. These correlations are in Table 3. All correlations were significant. The strongest correlates of feature usage were ownership and current computer use, followed by self-ratings. The number of educational settings where a computer was used correlated relatively low with computer feature usage. This pattern was consistent across groups.

Table 3
Correlations With Use of Computer Features

Variable	Computer Feature						
	Mouse	Menus	Icons	Internet	E-Mail	Games	Graphics
Own a Computer	.52*	.48*	.50*	.50*	.52*	.24*	.30*
Currently Use a Computer	.50*	.36*	.36*	.43*	.41*	.20*	.21*
Self-Rating	.37*	.45*	.44*	.38*	.39*	.20*	.43*
# Education Settings Where Used a Computer	.14*	.25*	.20*	.13*	.12*	.11*	.11*

Note. $N = 722$, * $p < .01$.

The relationship between computer ownership and feature usage rates is further clarified in Figure 11 (see also Table A-21). Figure 11 depicts the two extremes of feature use, the “never” and “daily” categories, as a function of computer ownership. For the soldiers who owned a computer ($n = 541$), the data points represent the percentage who used each feature on a daily basis as well as the percentage who had never used a particular feature. The corresponding percentages are also given for those soldiers who did not own a computer ($n = 179$).

The graph clearly shows the impact of computer ownership on the likelihood of using the computer features covered in the survey. From 61% to 77% of those who owned a computer used a mouse, icons, menus, Internet, and/or e-mail on a daily basis, in contrast to 12% to 23% of those who did not own a computer. No more than 4% of those who owned a computer said

they never used at least one of these features, compared to 11% to 25% who did not own a computer.

An additional finding of interest was that experience with graphics and games was lower for each of the four groups, as depicted in Figure 11. This finding is clearly related to the lower overall frequency with which soldiers said they used these features (see Figure 7).

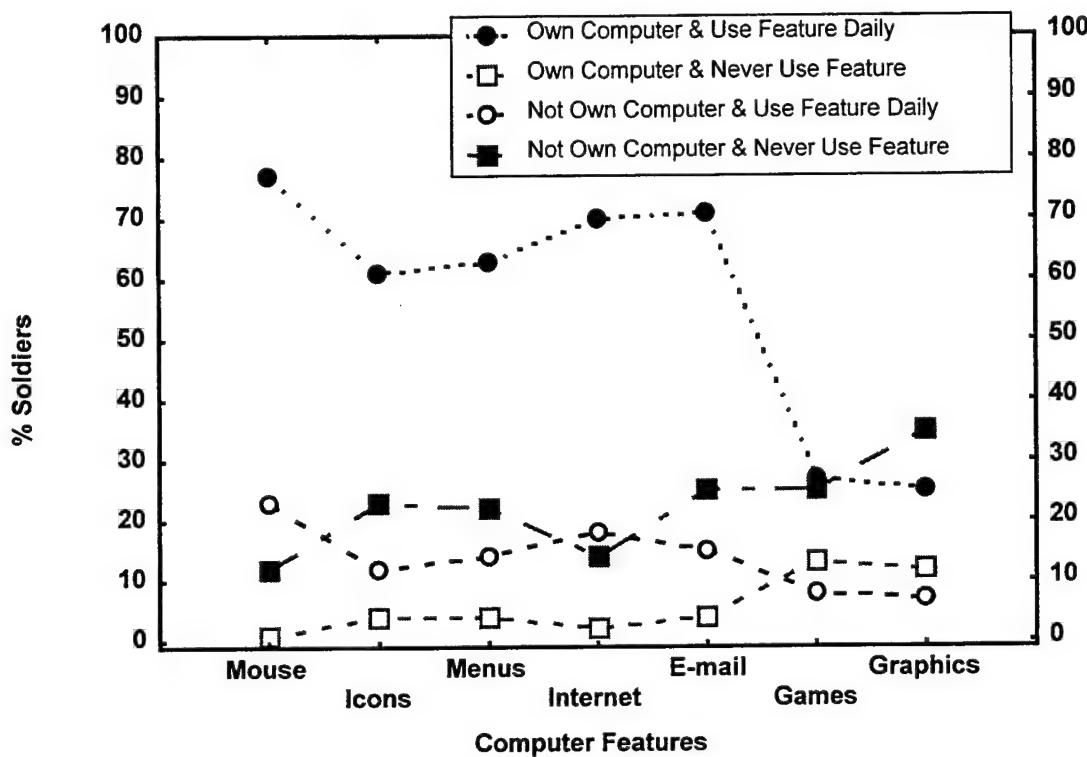


Figure 11. Relationship between computer ownership and frequency of use of computer features.

The correlations among the background variables are shown in Table A-22. Consistent with the data in Table 3, use of all computer features correlated significantly with owning a computer, self-rating, and using computers. Self-ratings correlated significantly, but less strongly, with the background variables. Lastly, the number of educational settings where soldiers used computers did not correlate highly with the other background variables.

Summary

The results showed a relatively consistent picture among the computer dimensions covered in the survey. The greater the computer background and use, the higher the soldiers' perception of their skill and the higher their scores on a test of computer knowledge. Moreover, the findings are consistent with the relatively rapid increase in the availability of personal computers in American society. The youngest soldiers (OSUT) had the greatest exposure to computers in high school. On the other hand, the oldest soldiers, those in ANCOC, had the least exposure to computers in high school. Most IOBC students had used computers in high school, and they also owned a computer, perhaps reflecting the demands made by today's colleges and universities on computer skills (most IOBC students had used a computer in college).

The computer backgrounds of the soldiers in the four courses are summarized in Table 4. The table illustrates several things. First, the pattern of computer experience varied with the soldier population. Computer experience was gained in different ways, reflecting the circumstances where computers were available to the different groups surveyed. These circumstances reflected differences in the soldiers' age, their job, their schooling experiences, and whether they owned a computer. For instance, the BNCOC and ANCOC soldiers did not use computers in grade school and junior high, but they did currently use them in their Army duty positions and in their homes. Second, there were commonalities among the groups. Clearly, a large percentage of soldiers from each group both owned and used a computer. In addition, home use by all was very typical.

Table 4
Computer Backgrounds of Students in Each Infantry School Course

Course	Own a Computer	Computer Experience				Use a Computer in Other Settings	
		Use a Computer in School				Use a Computer in Other Settings	
		Grade School	Junior High	High School	College	At Home	At Work
OSUT	✓✓	✓✓	✓✓✓	✓✓✓	✓	✓✓✓	
BNCOC	✓✓✓✓		✓	✓✓	✓✓	✓✓✓✓	✓✓✓
ANCOC	✓✓✓✓			✓	✓✓	✓✓✓✓	✓✓✓
IOBC	✓✓✓✓	✓	✓	✓✓✓	✓✓✓✓	✓✓✓✓	

Note. A single ✓ check mark indicates a factor was characteristic of 20% to 39% of the soldiers.

Two checkmarks ✓✓ indicate a factor was characteristic of 40% to 59% of the soldiers.

Three checkmarks ✓✓✓ indicate a factor was characteristic of 60 to 79% of the soldiers

Four checkmarks ✓✓✓✓ indicate a factor was characteristic of 80% to 100% of the soldiers.

The frequency of using five of the seven computer features included in the survey (menu systems, e-mail, internet, mouse, icons) was high – typically on a weekly to daily basis. Ownership impacted use of features. Of the soldiers who owned a computer, over 60% indicated they used these features on a daily basis, compared to daily use by less than 20% of the soldiers who did not own a computer. In addition, there was a consistent difference among the courses, with IOBC and ANCOC students using these five features the most frequently and OSUT the

least. Use of games presented a different picture. IOBC students used games on a monthly basis, while OSUT soldiers used games more frequently; that is, less than weekly but more than monthly. Graphics were used the least (on a monthly basis) by all soldiers; a finding which has training implications for soldiers using tactical software interfaces requiring graphics skill with military maps.

It is reasonable to assume that the computer experiences of the soldiers were not equivalent. For example, using computers in grade school is not the same as using them in college, nor are either of these situations the same as using computers in military duty positions. However, it was not possible to determine which types of computer experiences contributed the most to the different levels of computer knowledge and confidence exhibited by the groups of soldiers as reflected in their self-ratings and icon scores.

The two indices of computer skill revealed slightly different pictures of expertise for the four groups. For self-ratings, the IOBC ratings were significantly higher than each of the other groups, due primarily to fewer novice ratings and more soldiers indicating programming experience. On the other hand, with the icon scores, IOBC and ANCOC soldiers each scored significantly higher than BNCOC and OSUT soldiers. Thus both the self-ratings and the icon scores were consistent for OSUT, BNCOC, and IOBC. OSUT and BNCOC soldiers were low on each index and IOBC soldiers were high. However for the ANCOC soldiers, the icon scores indicated more expertise than that reflected by their personal assessment of their skill.

In the FY99 and FY00 surveys (Dyer & Martin, 1999; Fober, et al., 2000), it was estimated that 50% to 60% of the OSUT and BNCOC students would benefit from training on basic computer skills. Would these estimates be the same for FY01? The estimation procedure was based on the subjective and objective indices in the survey, consistent with recommendations by Van Vliet et al. (1994). To assess the need for computer training, they stated that measures of computer literacy should combine self-appraisals with objective tests, and even with hands-on testing. They defined computer literacy as "the ability to use microcomputers confidently for obtaining needed information, solving specific problems, and performing data-processing tasks. This includes a fundamental understanding of the operation of microcomputers in general, as well as the use of several types of application software packages" (p. 838). This definition corresponds roughly to a self-rating of three (good with several software programs) on our six-point self-rating scale

The subjective and objective measures in our surveys did not meet all the measurement criteria specified by Van Vliet et al. (1994). However, we felt the self-ratings and icon scores could be used to obtain a rough estimate of the percentage of soldiers that might need training on basic computer skills before learning a specific software package. First, the percentage of all the soldiers who scored 50% or less on the icon items was computed. Second, the percentage of these soldiers who also rated themselves as novices or good with only one program (soldier below a rating of 3 on our scale) was determined. This latter percentage was always less than that based on the icon cut-off only. The point estimate of the percentage of soldiers needing training in basic computer skills was then defined as the mean of these two values. The spread around this estimate was based on the two values themselves: the upper limit was the percentage of soldiers scoring 50% or less on the icon test, while the lower limit was the percentage scoring

50% or less on the icon test who also rated themselves as novices or good with only one program. Using these values the following estimates of the percentages of soldiers needing training in basic computer skills were obtained:

OSUT	51% +/- 8%
BNCOC	51% +/- 7%
ANCOC	24% +/- 4%
IOBC	20% +/- 3%

The estimate was highest for OSUT and BNCOC, and least for ANCOC and IOBC. The accuracy of these estimates was the least precise (greatest spread) for OSUT and BNCOC, and the most precise (least spread) for ANCOC and IOBC. Based on these estimates, it appears that computer training would be advisable for about half of the OSUT and BNCOC populations, a slightly lower estimate than obtained with the FY99 and FY00 surveys.

In conclusion, the findings present a picture consistent with the increased accessibility to computer technology within the U. S. society at large. They indicate differences in computer usage patterns and levels of expertise within the Infantry population. And they indicate that currently a substantial portion of some segments of the Infantry population does not have the knowledge and skills required to take full advantage of the advanced digital systems being fielded in the force. Although the surveys covered only the Infantry population, the results can apply to soldiers in other branches of the Army with similar educational and military experiences.

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Appendix A

Data Tables

Table A-1
Descriptive Statistics on Age

Group	<i>N</i>	<i>M</i>	<i>Mdn</i>	<i>SD</i>	Min & Max Values	Lower & Upper Quartiles (25 th -75 th)
OSUT	250	20.43	19	2.31	17-35	18-22
BNCOC	139	27.99	28	3.62	22-40	25-30
ANCOC	190	33.38	33	3.96	27-52	31-36
IOBC	142	25.22	24	2.12	20-35	23-28

Note. $F(3, 717) = 565, p < .0001$. Mean age of all groups differed from each other.

Table A-2
Descriptive Statistics on Months Served in the Army

Group	<i>N</i>	<i>M</i>	<i>Mdn</i>	<i>SD</i>	Min & Max Values	Lower & Upper Quartiles (25 th -75 th)
OSUT	N/A	N/A	N/A	N/A	N/A	N/A
BNCOC	138	92.63	85	30.23	41-236	72-114
ANCOC	188	162.35	160	34.30	85-291	137-184
IOBC	139	33.00	11	40.69	1-186	5-50

Note. Months served not asked of OSUT soldiers.

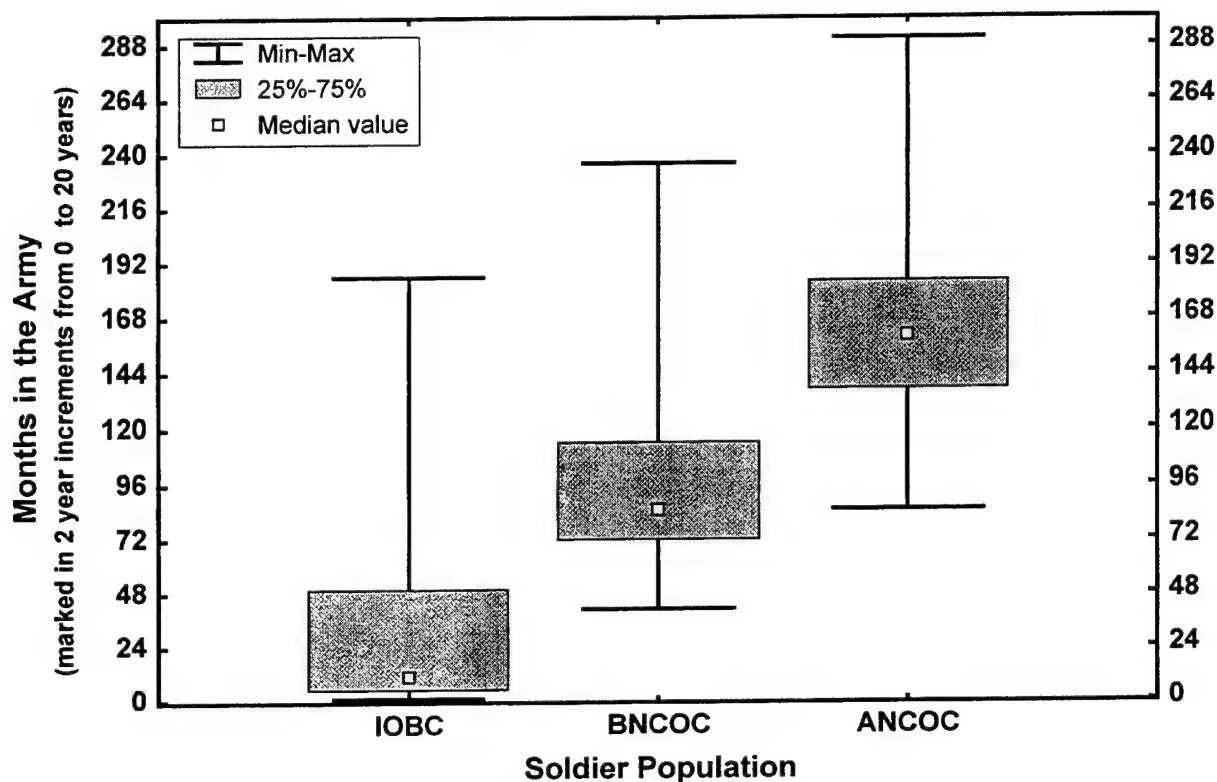


Figure A-1. Box plots of number of months served in the Army for IOBC, BNCOC, and ANCOC.

Table A-3
Percentage of Soldiers Using a Computer in Different Phases of Their Formal Education

Group	% Use Computer					
	Grade School	Junior High	High School	Technical School	College	Not Use
OSUT	40%	64%	79%	5%	20%	8%
BNCOC	5%	23%	54%	5%	40%	20%
ANCOC	2%	2%	26%	7%	56%	29%
IOBC	26%	26%	68%	3%	88%	2%

Table A-4
Number of Educational Settings Where Soldiers Used a Computer

Group	# Educational Settings Used a Computer					<i>M (SD)</i>	
	% Soldiers						
	0	1	2	3	4-5		
OSUT	8%	27%	24%	29%	12%	2.09 (1.17)	
BNCOC	20%	50%	16%	10%	4%	1.28 (1.03)	
ANCOC	29%	49%	18%	4%	0%	0.96 (0.79)	
IOBC	2%	33%	23%	19%	23%	2.29 (1.22)	

Table A-5
Percentage of Soldiers Indicating Computer Ownership and Current Use of a Computer

Group	% Own a Computer	% Use Computer Now	Where Currently Use Computer			
			Home	Work/Unit	Trng Facility	Not Specified
OSUT	59%	86%	75%	22%	43%	15%
BNCOC	81%	96%	82%	63%	45%	0%
ANCOC	89%	98%	90%	79%	25%	0%
IOBC	79%	96%	88%	20%	24%	0%

Table A-6
Percentage of Soldiers Indicating Different Levels of Typing Skill

Group	Self Ratings of Typing Skill			
	Hunt & Peck Slowly	Hunt & Peck Quickly	Type Slowly	Type Quickly
OSUT	9%	46%	25%	20%
BNCOC	14%	41%	30%	15%
ANCOC	16%	42%	26%	16%
IOBC	6%	28%	25%	41%

Table A-7
Frequency With Which Computer Features are Used: Percentage Soldiers by Scale Category

Group	Frequency (% Soldiers)				
	Daily	Weekly	Monthly	< Monthly	Never
Mouse					
OSUT	53%	26%	5%	11%	5%
BNCOC	63%	24%	6%	2%	5%
ANCOC	75%	17%	4%	3%	1%
IOBC	70%	22%	1%	6%	2%
Internet					
OSUT	47%	25%	8%	12%	7%
BNCOC	57%	23%	6%	6%	8%
ANCOC	66%	23%	4%	4%	3%
IOBC	63%	27%	3%	7%	0%
E-Mail					
OSUT	45%	17%	10%	13%	15%
BNCOC	60%	19%	4%	7%	10%
ANCOC	66%	20%	5%	3%	6%
IOBC	63%	29%	3%	2%	3%
Menus					
OSUT	41%	25%	6%	19%	10%
BNCOC	41%	31%	9%	6%	12%
ANCOC	63%	19%	4%	6%	7%
IOBC	59%	22%	5%	9%	4%
Icons					
OSUT	38%	21%	12%	16%	12%
BNCOC	45%	30%	10%	6%	9%
ANCOC	63%	19%	4%	6%	7%
IOBC	54%	23%	6%	13%	4%
Games					
OSUT	27%	32%	11%	20%	11%
BNCOC	31%	24%	9%	17%	20%
ANCOC	20%	29%	13%	28%	10%
IOBC	10%	24%	16%	23%	27%
Graphics					
OSUT	23%	14%	18%	28%	17%
BNCOC	14%	19%	17%	26%	24%
ANCOC	25%	17%	21%	23%	14%
IOBC	17%	14%	15%	38%	16%

Table A-8
Means (standard deviations) on the Computer Features Frequency of Use Scales

Feature	Soldier Population				
	OSUT (n=251)	BNCOC (n=139)	ANCOC (n=190)	IOBC (n=142)	All Groups (n=722)
Mouse	3.10 (1.22)	3.38 (1.35)	3.62 (0.79)	3.51 (0.93)	3.37 (1.05)
Internet	2.94 (1.30)	3.14 (1.26)	3.45 (0.97)	3.46 (0.86)	3.21 (1.15)
E-mail	2.64 (1.51)	3.11 (1.36)	3.39 (1.09)	3.48 (0.88)	3.09 (1.32)
Menus	2.70 (1.41)	2.82 (1.36)	3.24 (1.24)	3.23 (1.16)	2.97 (1.33)
Icons	2.59 (1.43)	2.95 (1.28)	3.24 (1.24)	3.10 (1.22)	2.93 (1.34)
Games	2.44 (1.35)	2.30 (1.53)	2.19 (1.32)	1.67 (1.36)	2.20 (1.41)
Graphics	1.98 (1.42)	1.73 (1.38)	2.15 (1.40)	1.77 (1.34)	1.93 (1.40)
All Features	2.62 (1.11)	2.77 (1.05)	3.00 (0.94)	2.89 (0.81)	2.80 (1.01)

Note. Scale was 0 = never use, 1 = less than monthly, 2 = monthly, 3 = weekly, 4 = daily.

Table A-9
Descriptive Statistics on the Sum of Feature Use Ratings

Group	Sum of Feature Use Ratings					
	N	M	Mdn	SD	Min & Max Values	Lower & Upper Quartiles (25 th -75 th)
OSUT	251	18.36	20	7.83	0-28	14-25
BNCOC	139	19.43	21	7.40	0-28	16-25
ANCOC	190	21.12	23	6.46	0-28	19-26
IOBC	142	20.23	21	5.68	2-28	17-24

Note. The 7 features were rated on a 0 to 4-point scale, ranging from “never” used to “daily” use. Maximum score was 28 representing daily use of all 7 features; minimum score was 0 indicating a soldier never used any of the 7 features.

Table A-10
Percentage of Soldiers Indicating Different Levels of Computer Skill

Group	N	Self-Ratings of Computer Skill					
		Novice	Good w 1 softw program	Good w several Soft Progr	1 Progm Lang + Software	Several Progm Lang+Soft	Bill Gates hire me
OSUT	250	36%	21%	34%	7%	1%	1%
BNCOC	138	37%	22%	38%	4%	0%	0%
ANCOC	191	35%	15%	43%	5%	1%	2%
IOBC	142	16%	25%	43%	8%	7%	1%

Note. Sample size for each group is shown in Table A-11.

Table A-11
Descriptive Statistics on Self-Ratings of Computer Skill

Group	Self-Ratings of Computer Skill					
	N	M	Mdn	SD	Range	Interquartile
OSUT	250	2.18	2	1.09	1-6	1-3
BNCOC	138	2.08	2	0.94	1-4	1-3
ANCOC	191	2.26	3	1.10	1-6	1-3
IOBC	142	2.68	3	1.11	1-6	2-3

Note. Scores: Novice = 1, One software program = 2; Several software program = 3, One program language + software = 4, Program languages + software = 5; Bill Gates hire = 6.

Table A-12
Percentage of all Soldiers Indicating Experience With Computer Software Programs and Programming Languages

	Percentage of Soldiers				
	OSUT (n = 251)	BNCOC (n = 139)	ANCOC (n = 191)	IOBC (n = 142)	All Groups (n = 723)
Software Programs					
Office Type	12%	19%	22%	24%	18%
Word Processing	25%	29%	31%	37%	30%
Spreadsheets	10%	22%	29%	30%	21%
Graphics	13%	17%	21%	28%	19%
Operating Systems	26%	10%	15%	15%	18%
Other Software	3%	11%	15%	14%	10%
Programming Languages	6%	2%	5%	18%	7%

Note. Not all soldiers who said they were skilled with software packages answered these questions. A soldier was counted only once if he indicated skill with more than one software program within a specific category, e.g., knew both Word and Word Perfect, or knew several programming languages, Basic, C++, and Pascal. Excluded from the tallies were generic responses such as "spreadsheets," "word processing," and "all graphics" programs. To be included in the count, a specific software program had to be listed by the soldier.

Table A-13

Percentage of all Soldiers Indicating Experience With Specific Software Programs and Languages

	Percentage of Soldiers				
	OSUT (n=251)	BNCOC (n=139)	ANCOC (n=191)	IOBC (n=142)	All Groups (n=723)
Office Type					
Microsoft Office	7%	15%	21%	21%	15%
Microsoft Works	5%	3%	1%	3%	3%
Other	0%	1%	0%	1%	1%
Word Processing					
Microsoft Word	20%	29%	30%	32%	27%
Word Perfect	5%	0%	1%	4%	3%
Other	0%	0%	0%	0%	0%
Spreadsheets					
Microsoft Excel	9%	22%	29%	26%	20%
Other	0%	0%	0%	3%	1%
Graphics					
Power Point	4%	14%	21%	20%	14%
Photo Shop	2%	0%	0%	4%	2%
Other	6%	0%	0%	4%	4%
Operating Systems					
Windows	23%	9%	13%	12%	15%
DOS	3%	2%	1%	2%	2%
Other OS	1%	0%	1%	0%	1%
Other Software					
Form Flow	0%	4%	5%	1%	2%
Calendar	2%	2%	1%	0%	1%
Financial	0%	2%	0%	2%	1%
Internet/E-mail	7%	0%	3%	4%	4%
Access	0%	4%	5%	6%	3%
Other	1%	0%	3%	5%	2%
Programming Languages					
BASIC	1%	1%	1%	3%	1%
PASCAL	0%	0%	0%	4%	1%
C++	2%	1%	2%	3%	2%
ADA	0%	0%	0%	4%	1%
HTML	2%	0%	1%	0%	1%
Other	3%	0%	1%	5%	6%

Note. Not all the soldiers who indicated skill with software packages answered this question. Each citation of a specific software package or programming language was tallied in computing the percentages. If a soldier cited Power Point and Photo Shop, each was tallied.

Table A-14
Percentage of Non-novice Soldiers Listing Software Programs

	OSUT	BNCOC	ANCOC	IOBC	All Groups
# of Non-Novice Soldiers	159 of 250	87 of 138	125 of 191	119 of 142	490 of 721
Response Rate by Non-novices	74% (117/159)	68% (59/87)	82% (103/125)	77% (92/119)	76% (371/490)
% Non-Novice Soldiers Listing Programs by Software Category					
Office Type	26% (30/117)	42% (25/59)	40% (41/103)	37% (34/92)	35% (130/371)
Word Processing	52% (61/117)	66% (39/59)	55% (57/103)	58% (53/92)	57% (210/371)
Spreadsheets	20% (24/117)	52% (31/59)	50% (52/103)	46% (42/92)	40% (149/371)
Graphics	29% (34/117)	41% (24/59)	37% (38/103)	44% (40/92)	37% (136/371)
Operating Systems	52% (61/117)	24% (14/59)	27% (28/103)	23% (21/92)	33% (124/371)
Other Software	18% (21/117)	29% (17/59)	28% (29/103)	27% (25/92)	25% (92/371)

Note. A soldier was counted only once if he indicated skill with more than one software program in a specific category, e.g., knew both Word and Word Perfect word processing programs. To be included in the count, a specific software program, by name, had to be listed by the soldier.

Soldiers who indicated novice computer skill but answered the software question were eliminated from this analysis ($n = 18$).

Table A-15

Percentage of Soldiers Listing Programming Languages as a Function of Self-Rating

Response Rates	OSUT	BNCOC	ANCOC	IOBC	All Groups
All Skill Levels	6% (16/251)	1% (2/139)	5% (9/191)	18% (25/142)	7% (52/723)
Non-Novices	10% (16/159)	2% (2/87)	7% (9/125)	21% (25/119)	11% (52/490)
Breakdown for Non-Novices					
Soldiers With no Programming Experience	2% (3/136)	0% (0/82)	3% (3/112)	9% (9/96)	4% (15/426)
Soldiers With Programming Experience ^a	56% (13/23)	40% (2/5)	46% (6/13)	70% (16/23)	58% (37/64)

Note. A soldier was counted only once if he indicated skill with more than one programming language, e.g., knew Basic, C++ and Pascal. To be included in the count, a specific programming language had to be listed by the soldier. No soldiers who rated themselves as novices answered the programming question.

^a This is the only group of soldiers who should have answered the question. However, there were 15 of 426 who said they had no programming experience and listed a programming language.

Table A-16
Percentage of Non-Novice Soldiers, Within Each Software Category, Who Listed Specific Software Programs

Software Category	Percentage of Soldiers				
	OSUT <i>(n = 117)</i>	BNCOC <i>(n = 59)</i>	ANCOC <i>(n = 103)</i>	IOBC <i>(n = 92)</i>	All Groups <i>(n = 371)</i>
Office Type					
Microsoft Office	60% (18/30)	80% (20/25)	95% (39/41)	88% (30/34)	82% (107/130)
Microsoft Works	40% (12/30)	16% (4/25)	2% (1/41)	12% (4/34)	16% (21/130)
Other	3% (1/30)	4% (1/25)	2% (1/41)	0% (0/34)	2% (3/130)
Word Processing					
Microsoft Word	79% (48/61)	100% (39/39)	98% (56/57)	87% (46/53)	90% (189/210)
Word Perfect	20% (12/61)	8% (3/39)	5% (3/57)	11% (6/53)	9% (19/210)
Other	2% (1/61)	0% (0/39)	2% (1/57)	0% (0/53)	1% (2/210)
Spreadsheets					
Microsoft Excel	96% (23/24)	100% (31/31)	100% (52/52)	88% (37/42)	96% (143/149)
Other	12% (3/24)	0% (0/31)	0% (0/52)	12% (5/42)	5% (8/149)
Graphics					
Power Point	32% (11/34)	80% (19/24)	100% (38/38)	72% (29/40)	71% (97/136)
Photo Shop	20% (7/34)	4% (1/24)	0% (0/38)	17% (7/40)	11% (15/136)
Other (e.g., Adobe, Corel Draw)	56% (19/34)	21% (5/24)	0% (0/38)	20% (8/40)	23% (32/136)
Operating Systems					
Windows	95% (58/61)	100% (14/14)	93% (26/28)	86% (18/21)	93% (116/124)
DOS	16% (10/61)	14% (2/14)	7% (2/28)	14% (3/21)	14% (17/124)
Other OS	13% (8/61)	0% (0/14)	14% (4/28)	5% (1/21)	10% (13/124)

Other Software					
Form Flow	0% (0/21)	35% (6/17)	41% (12/29)	4% (1/25)	21% (19/92)
Calendar	14% (3/21)	23% (4/17)	14% (4/29)	0% (0/25)	12% (11/92)
Financial	0% (0/21)	18% (3/17)	3% (1/29)	8% (2/25)	6% (6/92)
Internet/E-mail	100% (21/21)	0% (0/17)	17% (5/29)	0% (9/25)	36% (35/92)
Other	19% (4/21)	35% (6/17)	62% (18/29)	76% (19/25)	51% (47/92)

Note. Not all the soldiers who indicated skill with software packages answered this question. Each citation of a specific software package was tallied in computing the percentages. For example, if a soldier more than cited Power Point and Adobe, both types of graphics packages, each was tallied. Consequently, within each software category, the sum of the percentages for soldiers within a specific course can be greater than 100%.

Table A-17

Percentage of Soldiers With Programming Experience Listing Specific Programming Languages

Programming Languages	OSUT (n=13)	BNCOC (n = 2)	ANCOC (n = 6)	IOBC (n = 16)	All Groups (n = 37)
BASIC	30%	50%	17%	54%	35%
C++	46%	50%	17%	19%	30%
Pascal	8%	0%	33%	50%	30%
ADA	0%	0%	0%	56%	24%
HTML	31%	0%	17%	6%	16%
Other	77%	0%	50%	56%	59%

Note. Overall response rate to this question was 58% (see Table A015). Each citation of a specific programming language was tallied in computing the percentages. If a soldier cited BASIC and C++, each was tallied. Consequently column sums for soldiers within a specific course can be greater than 100%.

Table A-18
Descriptive Statistics on Icon Test Scores

Group	Descriptive Statistics (18 Icons)					
	<i>M</i>	<i>Mdn</i>	<i>Range</i>	<i>SD</i>	% <=50% correct (Score of 9)	Interquartile Range
OSUT	8.27	8.5	0-15	3.36	55%	6-11
BNCOC	8.67	9	0-15	3.32	57%	6-11
ANCOC	10.75	11.5	2-17	3.38	28%	9-13
IOBC	11.14	11.5	0-17	3.19	22%	10-13.5

Table A-19
Percentage of Soldiers Correctly Naming Each Icon

Group	Icon Name						
	<i>N</i>	Spell Check	Cursor	Zoom	Open File	Save	Print
OSUT	250	74%	66%	62%	73%	42%	75%
BNCOC	135	85%	61%	54%	70%	48%	77%
ANCOC	189	86%	61%	60%	82%	68%	87%
IOBC	140	87%	64%	78%	84%	84%	90%
		Cut	Copy	Paste	Undo	New File	Arrow
OSUT	250	81%	32%	11%	30%	10%	0%
BNCOC	135	86%	28%	18%	35%	10%	2%
ANCOC	189	93%	48%	33%	66%	21%	1%
IOBC	140	94%	57%	37%	54%	29%	2%
		Recycle	Help	Center	Fill	Close	Group
OSUT	250	87%	73%	32%	13%	49%	1%
BNCOC	135	90%	63%	41%	13%	63%	4%
ANCOC	189	94%	73%	69%	26%	70%	11%
IOBC	140	89%	88%	63%	29%	47%	6%

Table A-20

Relationship Between Self-ratings, Feature Usage Frequency and Icon Difficulty

Icon	% Correct Overall	Self-ratings		Computer Features Used	
		% Correct For Novices	% Correct For More Experienced	% Correct For Bottom-third	% Correct For Top-third
Easiest Icons					
Recycle	90%	84%	93%	81%	96%
Cut	89%	74%	96%	74%	97%
Spell check	82%	67%	93%	66%	91%
Print	82%	75%	87%	70%	88%
Open file	77%	64%	85%	66%	89%
Icons of Intermediate Difficulty					
Help	74%	57%	86%	59%	84%
Cursor	64%	55%	69%	53%	70%
Zoom	63%	49%	72%	51%	73%
Save	58%	35%	74%	35%	75%
Close	57%	50%	61%	49%	63%
Center	50%	28%	65%	34%	62%
Undo	45%	23%	59%	26%	62%
Copy	40%	23%	55%	23%	54%
Hardest Icons					
Paste	23%	8%	34%	12%	34%
Fill	20%	7%	30%	7%	32%
New file	17%	4%	25%	9%	26%
Group	5%	1%	8%	2%	9%
Arrow	1%	0%	2%	1%	3%

Note. The groups were combined for this analysis. The soldiers who described themselves “novices” scored lower (see percentages above) than “more experienced” category soldiers who said they were experienced with at least several software programs as well as those who said they could program (the top 4 categories of the self-rating scale). The frequency with which soldiers used the seven computer features varied for bottom-third (≤ 18) and top-third (≥ 24), and this was reflected in their ability to recognize icons (see percentages above).

Table A-21
Percentage of Soldiers Using Computer Features as a Function of Computer Ownership

Own a Computer	Frequency of Use				
	Never	< Monthly	Monthly	Weekly	Daily
Mouse					
Yes	1%	3%	1%	18%	77%
No	12%	17%	12%	36%	23%
Internet					
Yes	2%	4%	2%	22%	70%
No	14%	20%	14%	33%	18%
E-Mail					
Yes	4%	3%	3%	18%	71%
No	25%	19%	13%	28%	15%
Menus					
Yes	4%	6%	4%	23%	63%
No	22%	26%	11%	26%	14%
Icons					
Yes	4%	6%	5%	23%	61%
No	23%	24%	17%	23%	12%
Games					
Yes	13%	19%	13%	29%	27%
No	25%	32%	11%	25%	8%
Graphics					
Yes	12%	27%	19%	18%	25%
No	35%	33%	16%	9%	7%

Note. Within rounding error, rows sum to 100%. For all groups combined, the *N* for computer ownership = 541. *N* for no ownership = 179.

Table A-22
Correlations Among Background Variables

Background Variable	Soldier Group	Self-Rating	Own a Computer	Use a Computer	# Educational Settings
Use of Computer Features (Sum)	All	.47**	.54**	.42**	.29**
	OSUT	.55**	.52**	.43**	.29**
	BNCOC	.58**	.67**	.40**	.15
	ANCOC	.45**	.40**	.41**	.43**
	IOBC	.29**	.55**	.44**	.29**
Self-Rating	All		.28**	.17**	.28**
	OSUT		.30**	.22**	.20**
	BNCOC		.26**	.22**	.32**
	ANCOC		.28**	.17*	.40**
	IOBC		.22**	.06	.21*
Own a Computer	All			.27**	.12*
	OSUT			.15*	.05
	BNCOC			.40**	.06
	ANCOC			.32**	.20**
	IOBC			.23**	.17*
Use a Computer	All				.16**
	OSUT				.15*
	BNCOC				.13
	ANCOC				.18*
	IOBC				.08

Note. Sample sizes for each correlation varied with the number of missing data points for each variable. For the total sample the n = 723; OSUT n = 250; BNCOC n = 135; ANCOC n = 189; IOBC n = 140.

p* < .05, *p* < .01

Appendix B
Survey Forms

COMPUTER QUESTIONNAIRE

[Demographic Questions]

ANCOC and BNCOC Surveys

Name: _____ Age: _____ Rank: _____

Years and Months in Army: _____ years _____ months

Are you returning to the same position you held when you left your unit? Yes _____ No _____

If Yes, what is that position? _____

If No, what position are you going to? _____

IOBC Survey

Name: _____ Age: _____ Rank: _____

What is your source of commission? West Point _____ ROTC _____ OCS _____

Are you Active or Reserve component/National Guard? AC _____ RC _____

Years and Months Active Duty in Army: _____ years _____ months

Years and Months RC/NG in Army: _____ years _____ months

OSUT Survey

Name: _____ Age: _____

What is the highest level of education you have had?

High School _____

Technical School _____

Less than 4 yrs of college _____

Completed 4 yrs of college _____

Other _____

1. When did you use computers in your education? (*Circle all that apply*)

Grade School	Jr High	High School	Technical School	College	Did Not Use
--------------	---------	-------------	------------------	---------	-------------

2. Where do you currently use a computer? (*Circle all that apply*)*

Home/barracks/BOQ	Unit/Work Site	Library/Learning Ctr/Training Facility	Do Not Use
-------------------	----------------	--	------------

* This question was changed for the OSUT soldiers (i.e., **Before** coming to OSUT, where did you use a computer?)

3. For each of the following questions, circle the response that best describes you.

a. Do you own a personal computer? Yes No

b. How often do you:

- Use a mouse? Daily, Weekly, Monthly, Less Often, Never
- Play computer games? Daily, Weekly, Monthly, Less Often, Never
- Use icon-based programs/software? Daily, Weekly, Monthly, Less Often, Never
- Use programs/software with pull-down menus? Daily, Weekly, Monthly, Less Often, Never
- Use graphics/drawing features in software packages? Daily, Weekly, Monthly, Less Often, Never
- Use E-mail (at home or at work)? Daily, Weekly, Monthly, Less Often, Never
- Use the Internet? Daily, Weekly, Monthly, Less Often, Never

4. Which of the following best describes your typing ability? (*check ✓ one*)

Hunt and peck slowly
 Hunt and peck quickly
 Type slowly while not looking at the keyboard
 Type quickly while not looking at the keyboard

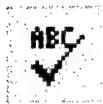
5. Which of the following best describes your expertise with computers? (*check ✓ one*)

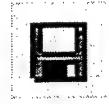
Novice
 Good with one type of software package (such as word processing or work calendars or slides)
 Good with several software packages
 Can program in one language and use several software packages
 Can program in several languages and use several software packages
 Expert – Bill Gates would hire me

If you are good with one or more software packages, please list them.

If you can program in one or more languages, please name these languages.

6. What is the function of the following icons?



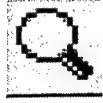










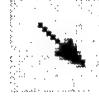


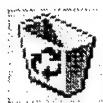




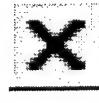






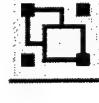












We thank you for providing information on your computer background, and appreciate your cooperation and time devoted to this survey.

Full confidentiality will be maintained in the processing of all data.

US Army Research Institute for the Behavioral and Social Sciences, Ft. Benning, GA.

Appendix C
Scoring of Computer Icons

Spellcheck Spelling	 Save to disk Save Save to hard drive To save information	
Mouse/Point Point>Select Mouse Arrow or Pointer Points to desired function Return to point/click icon or cursor itself Large Mouse Pointer To choose options on screen Use of mouse (select)	Pointer Cursor Pointer Arrow  Print Printing Print Function 	
0: Click on item/Point 0: Indicator 0: Manipulate shape 0: Pick object or picture 0: To click on different icons 0: Switch to cursor or to arrow 0: To activate icons or put down menus	0: Mouse icon 0: Locator 0: Mouse 0: Points to Icons 0: Clicker 0: Arrow 0: Fax 0: Faxing 0: Printer 0: Printer page 0: Printer select 0: Printer (activate) 0: Copy 0: Magnify 0: Amplify 0: Enlarge  Cut Edit (cut out) Cut/Copy 	
Zoom Increase image Zoom in or out Magnify selected section on paper or picture	1/2: To search for something 1/2: Pointer magnifier 1/2: Search/Zoom 0: Print Preview 0: Enhance 0: Print preview 0: Bigger 0: Scan 0: View	1/2: Magnifies 1/2: Search 1/2: Find 1/2: Make item larger 0: Next page 0: Preview 0: Closer look 0: Look 0: View Document 0: Cut pages 0: Edit a document 0: Cut <u>and</u> paste 0: Clip 0: Cut sentences 0: Cut/Paste

<p>Open file/Document Open folder To Open Files</p> <p>0: Open Cycle 0: File Download 0: File 0: Folder 0: Computer Folder</p>	<p>Open File Open</p> 	<p>Copy Duplicate</p>  <p>½: Paste or copy 0: Copied file 0: Print front and back 0: Page layout—All 0: Create Document 0: Show both pages</p> <p>½: Page 2 or copy 0: 2 sided 0: Paste copy 0: Pages 0: File 0: Copy/Paste</p>
<p>Recycle Bin Trash Bin Empty Trash</p> <p>½: Delete 0: Waste Basket 0: Garbage</p>	<p>Recycle Trash</p>  <p>½: Discard</p>	<p>Center Paragraph Align Text Center Center Align</p>  <p>½: Justify Center 0: Center page 0: Change Paragraph 0: Arrange Sentences 0: Letter Form 0: Align margins in middle</p> <p>½: Middle Align 0: Format 0: Margin 0: Text 0: Align 0: Center document</p>
<p>Paste Paste from clipboard</p> <p>½: Clipboard for copy/paste</p> <p>0: Proofread 0: Paste to clipboard 0: Attached file 0: Put certain data on clipboard 0: Detach from clipboard or clipboard only</p>	 <p>0: Clipboard 0: Notepad 0: Chart</p>	<p>Undo Go back or undo Undo/Redo</p>  <p>0: Backup one 0: Redo 0: Flip page 0: Back 0: Rotate 0: Last 0: Undelete</p> <p>0: Back step 0: Make subtitle 0: Flip over 0: Go back 0: Rotate text 0: Move to 0: Restore</p>
<p>Question/Help What is this Information</p> <p>0: Question</p>	<p>Help</p> 	<p>Fill with Color Shading Fill Color</p>  <p>½: Paint/Fill Color ½: Coloring ½: Paint Fill ½: Paste color</p> <p>0: Paint 0: Color</p> <p>½: Change Color ½: Fill/Unfill ½: Add Color</p> <p>0: Paintbrush 0: Font Color</p>

<p>New file</p> <p>New document [Word]</p> <p>New slide [PowerPoint]</p> <p>New workbook [Excel]</p> <p></p> <p>½: New</p> <p>½: File</p> <p>0: 1 sided</p> <p>0: Paste</p> <p>0: Page</p> <p>0: Document</p> <p>0: New page</p>	<p>Draw arrow</p> <p></p> <p>½: Drawer</p> <p>½: Draw a line/Draw line</p> <p>½: Arrow Tool</p> <p>½: Draw</p> <p>½: Draw tool</p> <p>½: Line</p> <p>0: Drag</p> <p>0: Pointer</p> <p>0: Special function</p> <p>0: Small mouse pointer</p> <p>0: Locator</p> <p>0: Angle text</p> <p>0: Cursor</p> <p>0: Arrow</p>
<p>Close Application</p> <p>Close Program</p> <p>Close Window</p> <p></p> <p>½: Close page</p> <p>½: Delete/Close File</p> <p>0: Max/Close</p> <p>0: Delete/Remove</p> <p>0: Cancel or leave page</p> <p>0: Open/Close</p>	<p>Group</p> <p></p> <p>½: Group or ungroup</p> <p>Grouping</p> <p>½: Combine</p> <p>0: Graphics alignment</p> <p>0: Resize</p> <p>0: Move Windows</p> <p>0: Graphic</p> <p>0: Minimize</p> <p>0: Size Objects</p>